# COMMENTS TO "LICENSING AND SAFETY REQUIREMENTS FOR LAUNCH; NOTICE OF PROPOSED RULEMAKING OCTOBER 25, 2000 DOCKET NUMBER FAA-2000-7953

COMMENTS SUBMITTED BY
KISTLER AEROSPACE CORPORATION
KIRKLAND, WA
APRIL 23, 2001

#### **Table of Contents**

Table of Contents	. 1
Introduction	. 2
1. General Comments.	. 2
A Less Ambiguous Presentation Would Be Helpful	. 2
NPRM Discourages New Development	
Operational Oversight Seems Unnecessarily Intrusive for a Presumably Commercial	
Operation	. 3
2. Risk Avoidance versus Risk Management	. 4
Risk Avoidance in Use of Aggregate Risk	. 4
Risk Avoidance in Requirements for Use of GPS	
Risk Avoidance in Ground Safety Analysis	. 5
3. New Rules Should Open the Door for a New Paradigm	

## COMMENTS TO "LICENSING AND SAFETY REQUIREMENTS FOR LAUNCH; NOTICE OF PROPOSED RULEMAKING" OCTOBER 25, 2000 DOCKET NUMBER FAA-2000-7953

COMMENTS SUBMITTED BY
KISTLER AEROSPACE CORPORATION
KIRKLAND, WA
APRIL 23, 2001

#### Introduction

Kistler Aerospace Corporation is pleased to submit these comments to the FAA's proposed rule governing the Licensing and Safety Requirements for Launch.

Kistler Aerospace is developing the first fully reusable launch vehicle and plans to service the satellite delivery market. Kistler is developing its K-1 launch vehicle using only privately raised capital. The K-1 is now 75% by weight complete and is awaiting the completion of funding to enable integration and final assembly.

Kistler understands that the subject rule is intended to "apply to all licensed launches of expendable launch vehicles." Strictly speaking, then, the FAA does not intend this NPRM to apply to Kistler's reusable K-1.

In other venues, however, the FAA has asked that industry provide feedback on FAA efforts. The FAA's stated goal is to help the American launch industry grow and remain competitive in the global market. It is in this spirit and with that goal in mind, that Kistler offers its comments on this NPRM.

#### 1. General Comments

#### A LESS AMBIGUOUS PRESENTATION WOULD BE HELPFUL

Kistler feels that the FAA should give more careful consideration to the seemingly ambiguous posture that the FAA projects in this and other NPRMs and which causes new rules to be unclear. The crux of this difficulty seems to lie in statements scattered throughout the NPRM such as the one in Section III, Part A where the FAA states that

"Although the proposed regulations would provide the requirements with which a licensee must comply, the FAA anticipates that a launch operator might wish to employ alternative means of achieving the same goal. In that case, if a launch operator can clearly and convincingly demonstrate an equivalent level of safety, the FAA would consider accepting that alternative..."

The FAA is to be complimented on recognizing that alternative approaches are likely to be proposed. However, language such as the above renders the NPRM ambiguous. Is industry to assume that the requirements presented in the NPRM are truly requirements, or should industry assume they are advisory?

The result of this ambiguous posture is that the licensing process remains unclear even after a final rule is approved. Since the real requirements are unclear, the extent to which any new system meets the requirements is unclear and the extent of the educational effort needed to get the new system approved is unclear.

As a remedy, Kistler would suggest that if the FAA intends the requirements to be requirements, then they should be unequivocally presented as such. If, however, the FAA truly intends to entertain alternative approaches, then the "requirements" presented in the NPRM, which would then be more accurately referred to as "preferred approaches," should be captured in Advisory Circulars.

#### NPRM DISCOURAGES NEW DEVELOPMENT

At the same time, Kistler feels that several of the proposed requirements discourage new development. For example, in Section III.2, the FAA states that

"Unless otherwise approved during the licensing process, the proposed regulations would require a launch operator to employ a traditional U.S. flight safety system where flight termination is accomplished by destroying the launch vehicle..."

Further on in Section III.F.7, the NPRM states

"The FAA's proposed requirements, like those of the federal ranges, would require a flight termination system to destroy a vehicle in order to reduce, if not eliminate, the potential for explosive effects upon debris impact."

Recognizing that this NPRM is intended for ELVs, and recognizing that most ELVs will in fact utilize a traditional flight safety system, and recognizing that the above statement indicates that the FAA is at least willing to consider alternative approaches, Kistler still believes that a performance based regulation would be preferable. Such a performance-based standard could be accompanied by a statement that an example of a flight safety system already accepted by the FAA is presented in an Advisory Circular.

### OPERATIONAL OVERSIGHT SEEMS UNNECESSARILY INTRUSIVE FOR A PRESUMABLY COMMERCIAL OPERATION

Proposed section 417.11(e) requires that the launch operator provide the FAA with a console for monitoring the progress of the countdown and communications on all

channels of the countdown communications network. The launch operator would be required to poll the FAA over the communications network during the countdown.

While Kistler recognizes that this is traditionally how launch operations are overseen at the national test ranges, Kistler would hope that the FAA would take advantage of this NPRM to define a new paradigm of launch safety oversight.

In other transportation industries, notably the commercial airline industry, government oversight involves the approval of operational procedures and approval of the training of operations personnel. These approvals are backed up by intermittent government inspections and audits of operator facilities and records, not polling before each and every flight.

For the FAA to require a console at each and every commercial launch, and for the FAA to require that it be polled as part of each and every countdown is antithetical to the commercialization of the launch industry. While test ranges are perhaps justified in demanding involvement on this level due to the nature of the systems being demonstrated, operational launch sites should be treated differently.

Kistler would maintain that FAA approval of procedures and personnel training/experience should be adequate to ensure the safe operation of launch systems, ELV or RLV.

#### 2. Risk Avoidance versus Risk Management

The recent report from the National Research Council, <u>Streamlining Space Launch Range Safety</u>, identified several aspects of government oversight of launch safety where a risk avoidance philosophy had crept into, and in some cases superseded, the more rational and productive risk management policy that was originally called for. Kistler believes that several aspects of the subject proposed rule indicate a similar and perhaps inadvertent adoption of this risk avoidance philosophy by the FAA.

Risk Avoidance in Use of Aggregate Risk

For example, in Section III.E.9, Collective Risk, the FAA proposes using an aggregate of all risks associated with an ELV launch, i.e. combining risk of debris impact, blast overpressure and toxic releases, as the figure of merit to assess a given ELV launch. In the associated discussion, the FAA admits that history has shown that "one hazard usually predominates as the source of risk." (FR Vol. 65, p 63936) The NPRM further states, "The conditions that are conducive to driving up the risk associated with one hazard usually render another hazard less significant. Also, as a general rule, most launch vehicles do not generate multiple risks." (Ibid)

Despite this, the FAA has expressed the desire "to limit acceptable risk to an aggregation of all hazards." (Ibid) Given the aforementioned historical record, this proposal would appear to be an attempt to avoid risk rather than manage it.

Risk Avoidance in Requirements for Use of GPS

Further evidence of a perhaps inadvertent risk avoidance strategy occurs when the NPRM discusses onboard tracking systems. The NPRM states that, "Onboard tracking system components, such as beacon transponders and GPS translators and their components must be independent of any system used to support the launch vehicle's inertial guidance system." (FR Vol. 65, p 63958)

Since any GPS unit will likely be included in a redundant fashion, this requirement could result in an ELV carrying two GPS units to feed the vehicle's inertial guidance system in a reliable manner, and two more GPS units to feed the vehicle's onboard tracking function. A net complement of four GPS units, but they could not be fully cross-strapped.

One can surmise that the reason for the requirement stated in the NPRM is that the FAA is concerned that the inertial system may feed erroneous data to the GPS unit, or that a power irregularity in the inertial unit would propagate to the GPS unit. It is fully within current technology, however, to isolate the GPS units from IMU data and to provide a separate power supply and surge protection for the GPS units. To be protecting against such occurrences through a requirement that the GPS units used for inertial measurement updates be completely independent of the GPS units used for onboard tracking, is indicative of a risk avoidance philosophy.

#### Risk Avoidance in Ground Safety Analysis

Further evidence of a risk avoidance philosophy are apparent in Section 417.405(f)(3) where the NPRM states with respect to ground safety that, "All hazards, both credible and non-credible, shall be identified. The probability of occurrence is not relevant with respect to identifying a hazard." (FR Vol. 65, p 64037)

The reality is that engineering judgement has always been applied to the identification of hazards for assessment. In such an analysis, each identified hazard must then have an estimated probability of occurrence determined. If engineering judgement is not allowed to truncate that list, eliminating hazards that are clearly irrelevant, extremely improbable or of no impact, then the magnitude of the work effort required to complete the analysis grows exponentially. These resources are better applied to analyzing the hazards that represent true risks.

The NPRM also states in Section 417.407(d) that, "When a hazard exists, a launch operator shall conduct daily inspections of all related hardware, software, and facilities to ensure that all safety devices and other hazard controls are in place for that hazard, and that all hazardous and safety critical hardware and software is in working order and that no unsafe conditions exist."

Kistler would argue that this, too, represents a risk avoidance, rather than a risk management strategy. Mandating daily inspections regardless of the likelihood of the hazard occurring and the magnitude of the risk it represents is unnecessarily burdensome and antithetical to the commercialization of the launch industry.

As a more appropriate model, Kistler would propose the commercial airline model where operators present their safety plans and procedures to the FAA for approval. While some specific items may be called out for mandated attention by the FAA, the FAA does not make blanket mandates regarding the operators' actions. The plans and procedures are revised as needed, and the FAA then undertakes occasional inspections and audits to ascertain that the operator is in compliance with the agreed upon plans and procedures.

Overall, Kistler would recommend that the NPRM be thoroughly reviewed with an eye toward items that indicate a risk avoidance posture, and that such items be revised and reconsidered.

#### 3. New Rules Should Open the Door for a New Paradigm

Kistler is aware that the FAA recently signed a Memorandum of Agreement with the Air Force for the development of compatible rules governing launches. Kistler is also aware that EWR 127-1 is the "stepping off point" for the regulation of commercial ELV operations. Kistler believes, however, that if the FAA finalizes this NPRM it will have missed a chance to open the door to new paradigms in launch operations.

EWR 127-1 is ultimately founded upon rules and procedures developed at the national ranges for the assessment and control of new missile system test programs. While the document has been through several incarnations, and is currently undergoing revision to make it a more performance based set of requirements, Kistler believes that it is incumbent upon the FAA to not block the development of new paradigms by adhering too closely to the requirements called out in EWR 127-1.

It is worth noting that the relationship between the FAA and commercial operators is a fundamentally different one than the relationship between the Department of Defense and its system developers. The Department of Defense develops new systems under its own initiative. Consequently the DoD can anticipate that system's operation and modify, or even waive, EWR 127-1 requirements as necessary to enable the testing of that system.

On the other hand, the FAA's position with respect to commercial launch operators is, of necessity, a more reactive one. New systems and capabilities tend to be developed more quickly, and changing the regulations or obtaining a waiver is not so easily accomplished.

To provide for more flexible rules, and to facilitate the development of new paradigms, Kistler would recommend that the NPRM requirements derived from EWR 127-1 and associated documents, as well as all of the Appendices attached to the NPRM, should be placed in Advisory Circulars. This would have the effect of granting more flexibility for the regulation of new and emerging technologies and

enable the United States to turn its technological advantage into a competitive one in the global launch market.